AUGMENTED OUTPUTS

—*Of Bristol Engines and Their B.H.P. : Particulars of New Models for the R.A.F. : New Gun Gear : Controllable Cooling : Sleeve Valve News*

THE vastly improved performance of the latest aircraft adopted for service with the R.A.F. is the outcome of technical advances in a number of directions. Cleaner aerodynamic design, the acceptance of higher wing loadings, slots and flaps, retractable undercarriages and variable-pitch airscrews all contribute to the general elevation. But there is another factor, an intangible one which is not evidenced in the collection of new and experimental aircraft at the R.A.F. Display, and that is the generous power available from contemporary aero-engines.

Not the least remarkable fact is that the greater number of the engines concerned are essentially similar to types which are already established in service. There is no better example of this than that of the Bristol Mercury and Pegasus units, the latest series of which are on order for Service equipment at ratings far is excess of those of present standard models. The margin of improvement in less than two years is of the order of 200 h.p. from both designs. For example, the Gauntlets now in service are fitted with Mercury VIS engines delivering a maximum power of 645 h.p.: the Mercury specified for the Gladiator and Blenheim is giving 840 h.p. Admittedly the height at which this power is obtainable is 1,500 ft. lower than in the former case, but the advance is, nevertheless, truly remarkable. Again, the Pegasus is known to the service with outputs up to 750 h.p. at 4,570 ft.; the Pegasus XX, now on order for machines like the Wellesley, is capable of developing 925 h.p. at 10,000 ft. The take-off power is 830 h.p.

Refinement

Although in capacity and general layout the new engines are similar to the more familiar models bearing the same type name, they incorporate certain refinements which are worthy of special note.

Extended research into the cowling question (a large amount of which has been recorded in *Flight*) has enabled the fins to be made deeper than in the previous series so that with the redesigned cylinder barrels, which have finning of closer pitch, there results an increase in cooling area of over 40 per cent.

The dry-sump lubricating system employed on the new engines follows normal Bristol practice, but now incorporates a device for providing a high initial oil pressure which enables the engines to be opened up to full power in a much shorter space of time than previously.

Two of the accessories which can be supplied with the new engines are of outstanding interest. The first is a device which has been christened the Bristol automatic advance gun gear control and has been introduced in view of the adoption of three-bladed airscrews, higher engine speeds and and an accelerated rate of fire. These innovations necessitate a more flexible type of synchronising control than has hitherto been provided by the fixed type of C.C. gun gear which has been standard equipment in the R.A.F. since the war.

With a three-bladed airscrew the relatively small angle between the blades demands a synchronising device which will automatically adjust the firing period to the airscrew speed and so remove the possibility of damage to the airscrew due to the firing period getting out of phase. And that is where the new gear comes in. It consists of a centrifugal governor which advances the cams as the engine speed increases to counteract the operational lag of the system.

The second device has already been referred to in *Flight*, but has not yet been described in detail. It is the controllable engine cowling which, by limiting the flow of cooling air to necessary proportions under various flight conditions, benefits performance. The cowl maintains uniform cylinder temperatures under all conditions of flight; makes for fuel economy under cruising conditions; provides an adequate control of air flow for ground running and extended taxying under tropical conditions; and, in the event of an engine failure on a multi-engined machine permits increased cooling air to be supplied to the remaining engines which would, of course, be working at higher outputs while the aircraft was travelling at the same, or possibly a lower, speed.

Adjustable Flaps

Essentially, the Bristol controllable cowling takes the form of a series of adjustable flaps round the trailing edge of a long-chord cowling. The principle of actuation of the flaps is an endless Reynolds chain running inside the rear cowl support ring and operating a screw mechanism through sprocket wheels. The gear is irreversible, so flight loads are self-contained. Complete with the rear cowl support ring the device weighs 25 lb. The final drive is suitable for manual, hydraulic or electrical operation.

The possible flap angle range is 0-30 degrees, but this is normally limited to 25 degrees, which represents $2\frac{1}{2}$ revolutions of the driving sprocket.

The following table, in addition to setting out data on the new types of Mercury and Pegasus engines for the R.A.F., gives figures for the Pegasus Xc engine, which is the power plant of the new Short Empire flying boats. The Pegasus Xc is the commercial version of the famous "X." All the engines listed are approved for use with de Havilland controllable-pitch airscrews. The power limits of the Pegasus XX, which, incidentally, has recently completed a highly satisfactory type test, are subject to official confirmation.

Development is still proceeding vigorously at the Bristol works on sleeve-valve engines, and figures for a new Perseus have just come to hand. The engine is designated the Perseus VIII, is moderately supercharged and, like its fellows, is of 1,520 cu. in. capacity. Running on fuel of 87 octane number its maximum output is 810 h.p. at 5,250 ft. and 2,525 r.p.m. For take off at sea level 700 h.p. is available.

	Mercury VIII and IX.	Pegasus X, XI and XII.	Pegasus Xc.	Pegasus XX.
Bore	$5\frac{3}{4}$in. (146 m/m.)	$5\frac{3}{4}$in. (146 m/m.)	$5\frac{3}{4}$in. (146 m/m.)	$5\frac{3}{4}$in. (146 m/m.)
Stroke	$6\frac{1}{2}$in. (165 m/m.)	$7\frac{1}{2}$in. (190.5 m/m.)	$7\frac{1}{2}$in. (190.5 m/m.)	$7\frac{1}{2}$in. (190.5 m/m.)
Cubic capacity	1,519 cu. in. (24.8 litres)	1,753 cu. in. (28.7 litres)	1,753 cu. in. (28.7 litres)	1,753 cu. in. (28.7 litres)
Airscrew rotation	L.H. tractor	L.H. tractor	L.H. tractor	L.H. tractor
Airscrew ratio	Merc. VIII 0.572 : 1 Merc. IX 0.500 : 1	Peg. X 0.50 : 1 Peg. XI 0.572 : 1 Peg. XII 0.666 : 1	0.50 : 1	0.50 : 1
Take-off power at maximum take-off r.p.m.	700/730 B.H.P.	920/960 B.H.P.	910 B.H.P.	830 B.H.P.
Maximum take-off r.p.m.	2,650	2,475	2,475	2,475
International rated power	795/825 B.H.P. at 13,000ft. (3,960 m.)	810/850 B.H.P. at 4,000ft. (1,220 m.)	740 B.H.P. at 3,500ft. (1,070 m.)	820 B.H.P. at 9,000ft. (2,745 m.)
Maximum climbing r.p.m. (International r.p.m.)	2,650	2,250	2,250	2,250
Maximum power for all-out level flight (5 minutes)...	810/840 B.H.P. at 14,000ft. (4,265 metres)	875/915 B.H.P. at 6,250ft. (1,905 metres)	790 B.H.P. at 5,500ft. (1,675 metres)	925 B.H.P. at 10,000ft. (3,050 metres)
Maximum level flight r.p.m. (5 mins.) ...	2,750	2,600	2,600	2,600
Nett weight to A.M. Schedule E. 124, Issue 3.	980 lbs. (444 kgs.)	1,005 lbs. (456 kgs.)	1,015 lbs. (460 kgs.)	1,015 lbs. (460 kgs.)
Diameter	51.5in. (1.307 metres)	55.3in. (1.405 metres)	55.3in. (1.405 metres)	55.3in. (1.405 metres)